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# ***JPRS Report***

# **Science & Technology**

***Science & Technology  
USSR: Earth Sciences***

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# Science & Technology

## USSR: Earth Sciences

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UDC 551.326.2(268)

**Variability of Ice and Snow Thickness in Arctic Seas and Its Parametrization**

18650143g Moscow *METEOROLOGIYA I  
GIDROLOGIYA* No 3, Mar 89 (manuscript received  
1 Jun 87) pp 80-87

[Article by I. L. Appel, candidate of geographical sciences, Arctic and Antarctic Scientific Research Institute]

[Abstract] The simultaneous presence of ice of different thicknesses exerts a significant effect on heat exchange between the ocean and the atmosphere. Data on mesoscale nonuniformity of ice thickness is also necessary for solving various practical problems related to navigation conditions. A method is proposed for stipulating the thicknesses distribution function on the basis of the

patterns of change in thicknesses of a hummock-free ice cover, the geometrical dimensions of hummocks and the area of the ice surface covered by hummocks. Procedures and formulas for determining each of these parameters are outlined. A comparison of the computed and observed parameters indicates a satisfactory accuracy of the proposed parametrization scheme. The spatial distribution of snow depth is examined and the reasons for its variability are clarified. In determining evolution of the state of sea ice information on minimal snow cover depth is of exceptional importance; the ratio of the minimal snow cover depth to its mean value is  $1/4$ . The proposed parametrization of the nonuniformity of the thicknesses of ice and snow can serve as a basis for a method for taking into account important factors operative in the thermal destruction of the ice cover in arctic seas during the melting period. Figures 3; references 17: 15 Russian, 2 Western.

**Research of Ionospheric Precursor Phenomena of Earthquakes**

18650141b *Frunze SOVETSKAYA KIRGIZIYA in Russian 14 Mar 89 p 4*

[Article by A. Barshay, interviewer]

[Excerpt] An All-Union Conference on Ionospheric Effects of Earthquakes took place recently in Moscow, at the Institute of Earth Magnetism, the Ionosphere and the Propagation of Radio Waves (IZMIRAN). Participants of this conference adopted a program for introduction into economic practice of methods for estimating the danger of earthquakes, tsunamis and volcanic eruptions, as well as a set of measures for reducing the amount of damage resulting from these phenomena.

Taking part in work of the conference at IZMIRAN were Doctor of Physical-Mathematical Sciences, Professor K. Karimov, head of the laboratory on atmospheric processes of the Kirgiz Academy of Sciences' Institute of Physics, and Candidate of Physical-Mathematical Sciences R. Gaynutdinova, a senior science associate of this laboratory. They presented a scientific paper.

Our correspondent asked Professor K. Karimov to tell in more detail about this new and apparently very encouraging direction of research of earthquake precursor phenomena.

"It is known that earthquakes result from the shifting and collision of thick plates of the lithosphere," said Kazimir Abdulovich. "During movements of these plates, enormous stresses and tremendous energy build up, giving rise to so-called magnetostrictions—active electric and magnetic fields. Electromagnetic radiations are propagated in all directions, but since the Earth's atmosphere is electrically neutral up to an altitude of about 50-80 kilometers, these radiations interact only with the ionosphere—the electrically active layer of the 'sky.' A kind of giant natural capacitor, whose two plates are the ionosphere and the lithosphere, occurs as a result.

"Two years ago, V. Migulin, corresponding member of the USSR Academy of Sciences and director of IZMIRAN, demonstrated that the ionosphere sends 'signals' about an impending intense earthquake at least several hours before it begins, and that these signals are more than 90 percent reliable.

"An ionosphere station is in operation at our laboratory, and we are conducting observations. But our station is a research facility, and we naturally are not in a position to conduct around-the-clock, large-scale and specialized monitoring. For this to be done, of course, our station must be expanded and strengthened, several more stations must be created on the republic's territory, and a special service must be organized to find and analyze ionospheric precursor phenomena of earthquakes."

FTD/SNAP

**Relationship Between Polar Motion and Earthquakes Studied**

18650163a *Moscow GUDOK in Russian 8 Apr 89 p 4*

[Excerpt] Earthquakes can be forecast from the movement of our planet's geographic poles. This is the inference to be drawn from research of Candidate of Technical Sciences P. Kotlyar of the Institute of Geology and Geophysics of the USSR Academy of Sciences' Siberian Branch. This scientist fed into a computer information on movements of the North Pole over many decades and on intense earthquakes during the same period. It thus became possible to check hypotheses of scientists that a connection exists between sharp changes in the pole's trajectory and underground tremors.

As is known, the Earth's top, while moving, 'traces' a spiral which alternately widens and narrows. Deviations in the spiral's smooth pattern sometimes occur. They were found to coincide in time with earthquakes. If the radius of the trajectory is small, intense earthquakes do not occur. They are noted only on large turns of the spiral. A period of 10 to 30 days passes between changes in the trajectory and the occurrence of earth tremors.

FTD/SNAP

**Hydrochemical Seismic Stations Deployed in Southeast Kazakhstan**

18650163b *Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 29 Mar 89 p 4*

[Article by V. Ganzha]

[Excerpt] Scientists of the [Kazakh] Academy of Sciences' Institute of Seismology have begun to obtain information about underground 'weather' from seismically active areas of Earth's interior in the Dzungarian Ala-Tau Mountains. Information needed for forecasting earthquakes is being received from new hydrochemical stations which have been created at the balneologic health resorts Dzarkent-Arasan and Kapal-Arasan in Taldy-Kurgan.

Ten such hydrochemical stations are now operating in southeast Kazakhstan, where several destructive earthquakes have occurred during the last hundred years alone. These stations were created in a seismically active zone more than 600 kilometers long, where thermal waters are abundant. This observation system has already enabled the scientists to form a bank of data on abnormal fluctuations of the chemical and gas composition of water sites.

Analysis of gathered data has shown that such changes signal the approach of underground shocks, as a rule.

"Measures must be taken not to only accelerate the building in Alma-Ata of a center for comprehensive earthquake forecasting but also to outfit this center with modern equipment," said N. Mikhaylova, secretary of the seismology institute's forecasting commission.

(A photograph is given showing engineer Sergey Badenko selecting a water sample for hydrogeochemical analysis.)

FTD/SNAP

### **Lack of Progress in Organizing Leningrad Earth-Studies Center**

18650171 Leningrad LENINGRADSKAYA PRAVDA in Russian 19 Apr 89 p 3

[Article by K. Kondratyev, academician, USSR State Prize Laureate; V. Savinykh, pilot-cosmonaut of the USSR, twice Hero of the Soviet Union; and O. Smoktiy, professor, doctor of physical-mathematical sciences]

[Abstract] The article presents arguments in favor of large-scale organization of research of the environment and natural resources in the Northwest region of the USSR.

Creation of a regional center in the Leningrad area similar to ones which have been organized abroad is advocated as an organizational reform which would make it possible to improve coordination of Earth studies, reduce their cost and provide facilities for gathering and processing large volumes of information.\* Among other things, it would facilitate joint use of space photographs and other aerospace information in environmental protection, the authors claim. A space photograph taken in the summer of 1988 from a satellite of the "Resurs" system is mentioned in this connection. This photograph shows how a portion of the Gulf of Finland looked after a dike had been built across the Neva estuary near Leningrad. Pollutants in the water of the gulf are said to be visible in the photograph. Comparison of this picture with earlier ones indicates that the estuary has become a closed reservoir with very limited exchange and mixing of waters since the dike was built, according to the authors.

The authors claim that a regional information network for monitoring, forecasting and management of natural resources could be created at minimal expense by using existing facilities of the USSR Academy of Sciences and the USSR state Committee on Hydrometeorology. A regional ecological information center would become the nerve center of this network. The authors point out that individual components of such a system already exist in the region; facilities which still must be created include specialized data banks, expert systems, and a modern center for receiving and processing satellite information. A long-term program for space Earth-resources and ecology studies has been drafted with the participation of Leningrad scientists, it is recalled. A decision to create a regional

center in Leningrad was adopted at an on-the-road meeting of the USSR Academy of Sciences' presidium about a year ago, but no action has been taken on this decision as yet. For further progress to be made in this direction, a joint effort on the part of the USSR State Committee for Nature Conservation and other concerned agencies may be necessary, in the authors' opinion.

A space photograph is given showing the Gulf of Finland in the area of the Leningrad dike.

### **Changes in Stress on Rocks Studied as Cause of Earthquakes**

18650141a Minsk SOVETSKAYA BELORUSSIYA in Russian 19 Mar 89 p 4

[Article by V. Marchenko, interviewer]

[Abstract] In an interview, Candidate of Geological and Mineralogical Sciences Vladimir Eduardovich Kovderko, docent of Gomel State University imeni Skorina, discusses the nature and possible practical applications of a theory of the origin of earthquakes which he has proposed.

According to this theory, an earthquake is produced by brittle spontaneous decomposition that occurs in rocks at deep levels of the earth which are under maximum stress. When the load on these rocks is removed relatively quickly, they behave like a powerful spiral spring, thrusting up the rocks above them. This load may be removed as a result of mining operations, or of displacement of loose material on the earth's surface during large mudslides and avalanches, for example.

Kovderko defends this hypothesis against criticism by other scientists, particularly G. I. Reysner and S. D. Vinogradov of the USSR Academy of Sciences' Institute of Earth Physics. Kovderko's confidence is based partly on the success of methods for forecasting and preventing rockbursts in mines, since he considers such bursts analogous to earthquakes. If his theory is proved, it can be used in forecasting earthquakes and even preventing them by reducing rock stress to a safe level, it is claimed. Kovderko thinks that government or Communist Party agencies should make it incumbent upon the earth-physics institute and other appropriate institutions to examine his hypothesis seriously.

FTD/SNAP

### **Atmospheric-Electricity Anomalies Linked to Seismic Activity**

18650150b Frunze SOVETSKAYA KIRGIZIYA in Russian 29 Mar 89 p 4

[Article by Yu. Blyum, correspondent]

[Abstract] The article reports on research of relationships between seismic phenomena and changes in atmospheric electricity. Work in this direction reportedly has been in progress for a number of years in the laboratory of atmospheric electricity at Kirgiz State University (KGU).

Doctor of Technical Sciences, Professor Savetbek Zhayloobekovich Toktomyshev, a researcher of the ozone layer, founder of the atmospheric-electricity laboratory and scientific director of the project, recalled that regularities governing anomalies of the electric field of the lowest atmospheric layer which occur prior to earthquakes were discovered for the first time by personnel of the laboratory. Both a deviation from the background value of the atmosphere's electric field and a change of its sign (anomaly) have been found to occur at the moment of an earthquake. Following an initiative taken by Yu. Bragin, a docent of Novosibirsk University, research of atmospheric electricity began in KGU's physics school in 1973 but was pursued only sporadically until 1987, when an agreement was concluded with the USSR State Committee on Hydrometeorology's Central Aerological Observatory, related A. Imankulov, the present head of the atmospheric-electricity laboratory. This agreement calls for methods and equipment to be developed for measuring electric fields at medium and high elevations. Imankulov mentioned that relationships have been established between changes in the electric field and solar eclipses and weather phenomena, including thunderstorms, cloudbursts and hurricanes.

The Armenian earthquake of December, 1988 reportedly has provided new impetus for research of seismic activity's effects on atmospheric electricity. Anomalies of the atmosphere's electric field have been recorded with the aid of an electric-field strength meter which S. Tatarinov, a graduate student of KGU, and V. Struminskiy, an associate of Novosibirsk University, developed.

This instrument has been awarded two bronze metals of the USSR Exhibition of National Economic Achievements and several certificates of invention. A pocket-size meter of this type can operate on solar batteries. A system for issuing warning signals has been proposed which includes the meter and a computer which processes its readings. With the aid of the meter, associates of the atmospheric-electricity laboratory discovered a field anomaly which occurred during the hours immediately preceding an earthquake at Fayzabad in 1984, and a change in polarity was detected a few hours before an earthquake near Przhevalsk in May of 1987, it is recalled. Industry still has not begun to mass-produce the meter, however.

Tatarinov and Struminskiy said that the laboratory's developments should not be regarded as perfected methods of forecasting earthquakes. Toktomyshev pointed out that the atmospheric phenomena which the scientists discovered can occur also in connection with thunderstorms, waterspouts, tsunamis and other extreme situations in nature. For precise forecasting methods to be developed, further study of these methods is needed with the participation of seismologists and other specialists in earthquake precursor phenomena, in his opinion. He suggested that the Kirgiz Academy of Sciences and its Institute of Seismology take steps to organize coordinated work in this direction.

FTD/SNAP

**Specialists Comment on Radiation Conditions  
Near Nuclear-Test Grounds**

18650162a Moscow KOMSOMOLSKAYA PRAVDA in  
Russian 26 Mar 89 p 1

[Excerpt] There has been quite a bit of talk about underground nuclear explosions at the testing grounds in Semipalatinsk Oblast affecting people's health and the weather. What do specialists think?

General-Lieutenant S. Zelentsov, deputy head of the Main Administration of the USSR Ministry of Defense: "We often receive letters containing such allegations from Pavlodar, Ut-Kamenogorsk and Altay Kray. Commissions including specialists of the Ministry of Health (Minzdrav), the State Committee on Labor and Wages, the country's Academy of Sciences and the State Committee on Hydrometeorology have been created more than once.<sup>1</sup> The Semipalatinsk Oblast Communist Party Committee turned to us in February, for example. A commission established that there have been no deviations in background radiation or seismicity."

K. Andrianov, engineer-physicist of USSR Minzdrav's Institute of Biophysics: "Background radiation at the testing grounds is 0.012 milliroentgen an hour. For purposes of comparison: background radiation is 0.012 to 0.02 milliroentgen an hour in Moscow and 0.06 milliroentgen an hour at the testing grounds in Nevada."

L. Buldakov, member of the USSR Academy of Medical Sciences, deputy chairman of the National Commission on Radiation Protection: "Observations of residents of all nearby population centers have been in progress from the time of the first nuclear explosion 40 years ago. When both ground and aerial bursts were being conducted in Semipalatinsk Oblast, background radiation really did increase. But such explosions have not been conducted since 1963, and background radiation has normalized."

**Footnotes**

1. See also the DAILY SNAP, March 31, 1989, p 4, col 1

**Progress of Weather Modification Service in  
Moldavia Reviewed**

18650162b Kishinev SOVETSKAYA MOLDAVIYA in  
Russian 23 Mar 89 p 3

[Article by L. Dinevich, head of the USSR State Committee of Hydrometeorology's service for active modification of hydrometeorological processes]

[Excerpt] In 1964, the first hail prevention contingent was created in the area of Moldavia where the risk of hail is the greatest. A large specialized service was organized in the republic during the next 25 years. This service consists of 14 hail prevention contingents; 230 weather-modification stations; contingents for artificially increasing precipitation from winter clouds, dispersing

supercooled fogs at the Kishinev airport and combating night frosts; and a number of other divisions. The area protected against hail damage is now 2.4 million hectares, and precipitation from winter clouds is being increased by aerial means over an area of 300,000 hectares. About 2,000 specialists are at work here. The service is equipped with modern specialized radar, communications equipment, computers, airplanes, and rocket complexes of the most peaceful kind.

Techniques have been developed for modifying certain types of clouds during the summer period, for the purpose of increasing precipitation.

Many enterprises of the republic, particularly the Kishinev Experimental Machine Plant of the Ministry of Local and Consumer Industry and the Precision Casting Machinery Association in Tiraspol, have rendered substantial assistance to the service in its development. Over a number of years, these enterprises have ensured shipment of special launching units for weather-modification stations.

Research and analysis of results of weather modification indicate that reagents based on silver iodide which are being employed are harmless to the soil, air and water, while small additions of iodine and silver to water are even beneficial.

Appropriate departments and administrations of the USSR State Committee on Hydrometeorology are coordinating and supervising work that is in progress, including work on questions of effectiveness and effects on the environment.

UDC 551.524.3:551.577.3:551.58"1981/1986"

**Warming of the 1980's**

18650143a Moscow METEOROLOGIYA I  
GIDROLOGIYA No 3, Mar 89 (manuscript received  
31 May 88) pp 5-10

[Article by M. I. Budyko, corresponding member, USSR Academy of Sciences, and P. Ya. Groyzman, candidate of physical and mathematical sciences, State Hydrological Institute]

[Abstract] An effort was made to find independent methods for checking estimates of anticipated regional climatic changes using materials from meteorological observations in the 1980's when the mean temperature for the northern hemisphere increased in comparison with the preceding decades by 0.2-0.3°C, and in comparison with the preindustrial era by 0.5-0.6°C. The study was based on archives for surface air temperature for 300 stations in the northern hemisphere for the period 1881-1986, monthly precipitation sums for 620 Russian stations for the years 1891-1986 and World Weather Records through 1985. These materials are compared with empirical data on climatic conditions of warm



epochs of the past. A series of maps and tables give the pertinent data: mean change in temperature field of the lower air layer in winter relative to the period 1951-1975; mean change in field of annual sums of precipitation during 1981-1985 relative to 1951-1975; changes in mean air temperature in winter for the 1980's for 11 regions in comparison with warm eras of past; changes in annual precipitation sums during global warmings of the past and comparison with the Holocene optimum. The pattern of change in the field of air surface temperature in winter during the first half of the 1980's in most cases agrees satisfactorily with the evaluation of this change which was made using data on warm epochs of the past. Such a comparison is impossible for the summer months because of the smallness of these changes in the 1980's. The problem of clarifying the change in the quantity of precipitation is more difficult. Figures 3; references 8; 7 Russian, 1 Western.

UDC [551.509.615].001.572

**Numerical Experiments With Three-Dimensional Model of Fog Crystallization and Modification Recommendations**

18650143b Moscow *METEOROLOGIYA I GIDROLOGIYA* No 3, Mar 89 (manuscript received 23 Feb 88) pp 27-37

[Article by V. I. Khvorostyanov, candidate of physical and mathematical sciences, and O. P. Kotova, Central Aerological Observatory]

[Abstract] The article gives the results of 31 numerical experiments for investigating zones of artificial crystallization and zones of improved visibility (ZIV) in fogs in a broad range of meteorological conditions. A three-dimensional mesoscale model was used in which the turbulence, wind, microstructure of droplet and crystalline phases, long-wave and solar radiation fields are computed. (The system of equations for the model, solution algorithm, initial and boundary conditions were described in detail by the author in *METEOROLOGIYA I GIDROLOGIYA*, No 4, 1987, and *TRUDY TsaO*, No 171, 1988.) The time of development of ZIV, their vertical and horizontal dimensions and dependence on temperature, wind and quantity of reagent are investigated. Recommendations are given for developing schemes for the positioning of surface systems for the dispersal of fogs and optimization of algorithms for their operation for ensuring the functioning of ICAO first- and second-category airports. Figures 3; references 21: 16 Russian, 5 Western.

UDC 551.515.2:551.513.7(062.5)

**Mean Meridional Circulation in Tropical Atmosphere**

18650143c Moscow *METEOROLOGIYA I GIDROLOGIYA* No 3, Mar 89 (manuscript received 22 Jan 88) pp 38-43

[Article by A. V. Kislov and Ye. K. Semenov, candidates of geographical sciences, Moscow State University]

[Abstract] The time-averaged (for July) three-dimensional pattern of atmospheric circulation was investigated in the tropics along different meridional sections.

The basis for the work was climatic data on the wind regime in the tropical zone atmosphere and the fields of vertical air movements constructed on their basis. The data were obtained from the FGGE observation system, archives of the USSR World Data Center and foreign publications. Four situations are examined in detail: 1) meridional circulation under "pure" oceanic conditions (in the example of the central part of the Pacific Ocean); 2) wind field section along 20°E, intersecting the African continent along its central part; 3) atmospheric dynamics over the Indian Ocean Basin; 4) meridional section along 60°W passing through South America, Caribbean Sea Basin and Western Atlantic. The air flow pattern was examined for sharply contrasting regions (land-sea juxtaposition). It is shown that there is a distinct breakdown of meridional circulation into a series of cells close in scales and localization to Hadley circulation cells. The possibilities of the existence of a Hadley circulation over purely oceanic regions and its impairment over regions with tropical monsoons are discussed. Figure 1; references: 9 Russian.

UDC [551.510.42:551.510.52].001.572

**Simple Model of Global Tropospheric Distribution of Gases of Low Chemical Activity From Industrial Sources**

18650143d Moscow *METEOROLOGIYA I GIDROLOGIYA* No 3, Mar 89 (manuscript received 26 Feb 88) pp 59-67

[Article by A. S. Kabanov, candidate of physical and mathematical sciences, Tayfun Scientific Production Association]

[Abstract] A simple stationary diffusion model describing the latitudinal distribution of the concentration of gases from industrial sources whose lifetime in the troposphere is considerably greater than the characteristic time of their mixing in the troposphere is proposed. The model takes into account the dependence of the properties of gas transport on the size of large-scale turbulent vortices in the atmosphere. The model was checked by a comparison of the computed and observed global fields of gas concentration in the atmosphere. It is shown that the gas concentration attains a maximum (with atmospheric vortices measuring  $10^3$  at approximately 70-80°N, whereas the minimum intensity of industrial sources is situated at about 50°N. With an increase in the extent of the vortices there is a decrease in gas concentration in the zone where the intensity of the source is maximal and an increase in the concentration outside this zone. The concentration maximum is displaced toward the north pole. The carbonyl sulfide concentration (from which the background sulfuric acid aerosol layer in the stratosphere for the most part is formed), computed as an example, changes appreciably with latitude in the northern hemisphere. Figures 3; references 17; 7 Russian, 10 Western.

### Oil Spill Clean-up Specialists Share Experience at Conference in United States

18650149a Moscow VODNYI TRANSPORT in Russian 23 Mar 89 p 4

[Article by I. Patrikeyev, correspondent, Baku]

[Excerpt] An American conference on environmental protection took place in San Antonio, Texas, late in February. A delegation of the USSR Ministry of the Merchant Fleet (Minmorflot) took part in this conference. Among the members of this delegation were Oleg Nikolayevich Khalimonov, head of the State Special Marine Service for Eliminating Spills of Oil and Petroleum Products on the Sea; I. Orlov, head of the Scientific-Technical Administration; S. Nunuparov, director of the Southern Scientific Research Institute of the Merchant Fleet; and T. Akhmedov, head of the Caspian Marine Shipping Line. Akhmedov gave an interview to our correspondent.

"Teymur Kafarovich, please tell about the conference's work."

"Taking part in it were 1,200 specialists from 35 countries. Papers were given and conversations took place. O. N. Khalimonov gave a paper, by the way. Sections operated. Minmorflot's capabilities for combating pollution of the sea were represented broadly and fully."

"Using the Caspian as an example?"

"Yes. There were good reasons for selecting our basin. The equipment of the Caspian Expeditionary Detachment for Emergency, Rescue, Ship-Raising and Underwater Technical Work is characteristic of such organizations in all marine shipping lines. We have two specialized vessels, the "Tigr" and the "Svetlomor-2," which are abundantly equipped with the latest instruments and all kinds of accessories. Installation of boom barriers from helicopters, which substantially reduces an area of pollution and promotes efficiency and quality of work, has been employed in the Caspian for the first time in the world. People have come from Denmark, Norway and France to adopt our experience. The next exercises are planned in September of this year."

FTD/SNAP

UDC 551.465

### Method for Test Range Hydrological Measurements

18650137c Moscow OKEANOLOGIYA in Russian Vol 28 No 6, Nov-Dec 88 (manuscript received 24 Jun 87) pp 1032-1034

[Article by G. G. Panteleyev and Ye. V. Semenov, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Improved approaches are required for the planning of oceanological surveys. This requires a determination of what survey parameters (number and positioning of stations, their number and distribution in

time) exert an influence on the accuracy of the decision. The proposed method consists of a number of stages: in the first stage it is necessary to obtain a "precise" solution, an analogue of a real process in nature; then, proceeding on the possibilities for executing the survey, several variants are tested and compared with the precise solution. Each of the stages was examined applicable to a test range occupied in the winter of 1983/1984 in the Gulf Stream region, where a survey was made in a uniform grid with a distance between stations 30 miles. A precise solution was obtained by solving the Cauchy problem with stipulation of the climatic state as the initial and boundary conditions. Three basic variants were examined. The first two variants were surveys with meridional sections "upstream" and "downstream." The third variant was a double pass along the test range contour with a small number of stations within the test range. In all variants of the surveys the total number of stations to a depth of 2000 m was 93. A table gives the results of a comparison for the level surface of the ocean. An additional variant, based on a diagnostic model, was also considered. The different variants are compared, with an indication of the relative merits of each. The influence of survey parameters in each specific case is significant. Figure 1; references 2: 1 Russian, 1 Western.

UDC 551.466.4

### Transformation of Waves by Current With Linear Velocity Shear in Depth

18650134a Moscow OKEANOLOGIYA in Russian Vol 29 No 2, Mar-Apr 89 (manuscript received 8 Dec 87, 31 May 88) pp 198-204

[Article by I. G. Kantarzi, I. L. Makarova and Ye. N. Pelinovskiy, VODGEO (Water Supply, Sewerage, Hydrotechnical Structures, and Hydrology) All-Union Scientific Research Institute, Moscow; Applied Physics Institute, USSR Academy of Sciences, Gorkiy]

[Abstract] The problem of transformation of surface waves by a current smoothly inhomogeneous along the direction of propagation and linear-shear in depth was investigated. Expressions are derived for determining the length and height of waves on a forward current or countercurrent as a function of depth, the surface current velocity or the mean current velocity with depth, and the velocity shear with depth. Relations are also derived for the kinematic characteristics of the blocking point of waves by a linear-shear countercurrent. It is shown that current velocity shear with depth exerts a substantial influence on the transformation of waves in deep water. Accordingly, in solving problems of interaction among waves and currents in deep water, such as when determining current velocities from measured wave fields, it is inadequate to characterize the current only by surface velocity; estimates of velocity shear with depth are also necessary. In shallow water the influence of velocity shear with depth on the transformation of waves by a current can be neglected in comparison with the influence of the current itself. In this case the current can be

described only by surface velocity or velocity averaged with depth. Available experimental data do not yet make it possible to check these results. Figures 2; references 10: 5 Russian, 5 Western.

UDC 551.465.47

**Local Influence of Bottom Relief and Orographic Instability of Zonal Quasigeostrophic Current**

18650134b Moscow OKEANOLOGIYA in Russian  
Vol 29 No 2, Mar-Apr 89 (manuscript received  
3 Jun 88) pp 212-218

[Article by G. M. Zhikharev, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A study was made of the possibility of the appearance of orographic instability and the related phenomenon of nonuniqueness of stationary circulation regimes in a barotropic model of a zonal current over an uneven bottom. Orographic instability is also possible in a case when the relief is inhomogeneous only in part of the movement region. There is a decrease in form drag, determining the development of instability. An analysis was made of the qualitative dependence of the solutions on the determining parameters of the problem: wavelength, describing inhomogeneous relief, its amplitude and the relative extent of the region with a flat bottom. With respect to the nonuniqueness of stationary solutions, the transition between them can occur rapidly, in the form of a jump. The range of parameters in which this phenomenon occurs decreases with either a decrease in the region of existence of nonuniform relief or with an increase in the wavelength of the nonuniform relief and a decrease in the number of nonuniformities in some fixed part of the region of fluid movement. This behavior of the solutions is noted for wave numbers on the order of unity. It determines the main difference in qualitative behavior in the case of locally nonuniform relief from a case in which relief is uniform in the entire region of movement. Figures 5; references 12; 2 Russian, 10 Western.

UDC 551.46.062.4

**Features of Thermohaline Characteristics of Sea Water in Presence of Gas Source**

18650134c Moscow OKEANOLOGIYA in Russian  
Vol 29 No 2, Mar-Apr 89 (manuscript received  
5 Dec 86) pp 226-227

[Article by N. N. Korchagin, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] An underwater gas source active on the floor of the Sea of Okhotsk at a depth of 770 m about 10 miles west of Paramushir was investigated in the summer of 1986 on the 11th cruise of the "Akademik Mstislav Keldysh." On echograms it had the form of a "gusher" about 500 m high. The submersible "Paysis" was used in studying this phenomenon. The gas jets emanated from a sector measuring 50 x 50 m. Individual gas bubbles, 1 cm in diameter, rose to the surface at a rate 0.2 m/s. The

formation of the gas jets is attributable to the decomposition of solid gas hydrates which consist of hydrocarbon compounds, largely methane, situated in the sedimentary rocks underlying the bottom of the investigated area. The "gusher" was also studied using a CTD profiler moving at a rate of less than 1 knot with statistical processing of the CTD data. A total of 920 temperature and salinity values registered at drift at a depth 760 m were used in constructing T(t) and S(t) series. The temperature spectra in the "gusher" zone were 1-1.5 orders of magnitude greater than the corresponding values outside the source, whereas the salinity spectra virtually coincided. Figure 1.

UDC 551.46(261.24):551.464:574.52

**Structure of Vertical Distribution of Dissolved Organic Carbon in Baltic Sea**

18650134d Moscow OKEANOLOGIYA in Russian  
Vol 29 No 2, Mar-Apr 89 (manuscript received  
4 Aug 87, after revision 20 Jun 88) pp 230-235

[Article by A. K. Yurkovskiy and S. S. Vladimirovskiy, Baltic Scientific Research Institute of Fishing, Riga; All-Union Scientific Research Institute of Fishing and Oceanography, Moscow]

[Abstract] Dissolved  $C_{org}$  in the Baltic Sea was determined using a Sybron Photochem E 3600 analyzer. The features of vertical distribution of  $C_{org}$  are examined in the example of three stations and four seasons in 1984-1985. The  $C_{org}$  concentration was in the range 2.85-4.81 (6.84) mg/liter; the vertical  $C_{org}$  profile has many peaks, not always with a maximum at the surface. It was found that the vertical distribution of  $C_{org}$  in Baltic Sea depressions has a specific structure, varying as a function of season and hydrochemical conditions in the depths. Detailed research revealed a specific pattern of distribution of dissolved  $C_{org}$  incompatible with the hypothesis of a monotonic decrease in its concentration with depth. The nature of vertical distribution of dissolved organic matter (DOM) in the Baltic is governed to a considerable degree by processes in the metabolic cycle of organic matter, layer-by-layer "regulated" by the hydrological cycle of water masses, by the presence of zones differing with respect to metabolism in communities. The coupling role of DOM in these communities and the intensive participation of its easily assimilated components in interorganism exchange make the DOM parameter a source of diverse information on the state of marine ecosystems. References 20: 7 Russian, 13 Western.

UDC 581.331.2:551.594.25(265.5)

**Palinological Characteristics of Aerosol Over Black Sea**

18650134e Moscow OKEANOLOGIYA in Russian  
Vol 29 No 2, Mar-Apr 89 (manuscript received  
28 May 86) p 285

[Article by A. V. Komarov, Southern Division, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Gelendzhik]

[Abstract] Pollen and spores were collected at 28 daytime and nighttime stations from aboard the "Akademik

S. Vavilov" during March- September 1974 for clarifying the paths of transport of pollen and spores over the Black Sea. The concentration of pollen and spores in the aerosol averages  $398/\text{cm}^2$ . The maximum concentration is observed at stations with northerly and northeasterly winds with a flow velocity 7-12 m/s. The greatest concentration falls at a distance 100- 150 km from the shore. The species composition of woody and grassy plants accounting for these pollens and spores was determined. This palinological research revealed the principal paths of transport of pollen and spores in the Black Sea Basin: northerly, northeasterly, easterly and in part southerly and westerly wind flows. The geobotanical regions, types of vegetation and formations supplying the sedimentation basin with pollen and spores were determined. The European broadleaf region is the principal source. In addition, in the formation of the spore-pollen spectra of aerosol an appreciable role is played by the European steppe region with steppe and desert vegetation, with a lesser role played by the Mediterranean region of evergreen forests.

UDC 591.524.12(26)

**Estimates of Numbers and Biomass of Phyto- and Zooplankton From Bioluminescence in Barents Sea**

18650134f Moscow OKEANOLOGIYA in Russian  
Vol 29 No 2, Mar-Apr 89 (manuscript received  
26 Apr 88) pp 286-292

[Article by O. A. Cherepanov, R. N. Utyushev, L. A. Levin, V. N. Nesterova and V. A. Pavlov, Biophysics Institute, Far Eastern Department, USSR Academy of Sciences, Krasnoyarsk]

[Abstract] A relationship was established between the total quantity of plankton and its fluorescent part and an evaluation was made of the possibility of predicting the total reserve of plankton on the basis of data from bioluminescence soundings in the Barents Sea. The work was done in two stages. The first stage involved compilation of a catalogue of luminescent species of phytoplankton and zooplankton; the second stage involved the statistical processing of bathometric and net samples on the basis of a list of luminescent species for different seasons, regions and depths. Table 1 is a list of luminescent phytoplankton species for the Barents Sea; Table 2 is a corresponding listing of zooplankton species. It was found that in arctic regions the luminescence of plankton can be used very successfully in estimating the numbers of zooplankton; its biomass can be estimated satisfactorily. The considerable variations in the percentage of luminescent phytoplankton during the course of the vegetation season cast doubt on whether its numbers and biomass can be estimated on the basis of bioluminescence. Figures 2; references 13: 5 Russian, 8 Western.

UDC 591.524.12(26)

**New Settler in Black Sea: Ctenophore Mnemiopsis leidyi (A. Agassiz) (Ctenophora: Lobata)**

18650134g Moscow OKEANOLOGIYA in Russian  
Vol 29 No 2, Mar-Apr 89 (manuscript received  
5 Dec 88) pp 293-299

[Article by M. Ye. Vinogradov, E. A. Shushkina, E. I. Musayeva and P. Yu. Sorokin, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] In the summer of 1987 the appearance of a new type of fauna was observed in the Black Sea: the ctenophore *Mnemiopsis leidyi* (A. Agassiz), an endemic of the Atlantic coast of North America, ranging from Florida to Chesapeake Bay and northward, inhabiting oceanic and brackish waters. In contrast to jellyfish, a microphage, *Mnemiopsis* is a macrophage. In the summer of 1988 it was observed en masse along the northern and western coasts of the Black Sea and in the Sea of Azov. It probably arrived in the Black Sea in the ballast waters of grain carriers making direct voyages from American ports to Odessa. In late September its biomass in the open waters of the eastern part of the sea attained  $1.5\text{-}2\text{ kg/m}^2$ . The main concentrations of the ctenophore were in the upper mixed layer above the seasonal thermocline. Evidently under the influence of the mass development of *Mnemiopsis* the biomass of jellyfish (*Aurelia*) declined at this time in comparison with that observed during the preceding 10 years by a factor of more than 20. The biomass of zooplankton, serving as food for ctenophores, also decreased sharply. The development of *Mnemiopsis* in the Black Sea will probably have strong seasonal fluctuations and later may go into decline, but for some time it will exert an appreciable influence on the ecosystem. References 19: 14 Russian, 5 Western.

UDC 551.465

**Evolution of Localized Turbulent Regions in Oceanic Pycnocline**

18650137a Moscow OKEANOLOGIYA in Russian  
Vol 28 No 6, Nov-Dec 88 (manuscript received  
25 Feb 87, after revision 9 Dec 87) pp 910-917

[Article by A. Yu. Benilov and B. L. Gavrilin, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Turbulence in the oceanic pycnocline, forming as a result of destruction of internal waves, is localized in limited regions and has an intermittent character. Turbulence generates a whole series of peculiarities in the transport of momentum, heat, salt and other admixtures in the pycnocline and forms the vertical fine structure of hydrophysical fields. It is evident that turbulence in such regions, the extent of the regions

and background stratification must be interrelated. An attempt was made to ascertain these correlations in the case of two- and three-dimensional turbulent regions. Using the equations of the semi-empirical theory of turbulence, the integral relations method is used in studying the influence of background stratification of the oceanic pycnocline on the evolution of such turbulent regions. Cases of turbulent formations with and without momentum are examined. The laws of degeneration of turbulence and change in the geometrical dimensions of turbulent regions are defined. The results are compared with data from laboratory experiments. References 17: 11 Russian, 6 Western.

UDC 551.51:629.78

**Correlation Between Anomalous Phenomena at Surface of Nicobar Strait and Features of Its Bottom Relief**

18650137b Moscow OKEANOLOGIYA in Russian  
Vol 28 No 6, Nov-Dec 88 (manuscript received 2 Jun 87, after revision 4 Nov 87) pp 939-943

[Article by A. V. Berezutskiy and Yu. D. Yevsyukov, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow; Southern Division, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Gelendzhik]

[Abstract] A morphological study was made in Nicobar Strait during the 11th cruise of the "Akademik Mstislav Keldysh" for ascertaining the influence of its bottom relief on dynamic processes transpiring in the overlying waters. While passing through the strait on 25 April 1986 there were regularly alternating parallel bands of anomalously restless waters separated by spaces with poorly developed waves. Acoustic soundings on this occasion, as at other times, revealed that the trains of short-period internal waves regularly observed in the southern part of the Andaman Sea may be generated under the influence of a tidal current on the western slopes of a complexly structured underwater ridge in the form of packets of lee waves which during attenuation of the tidal flow are propagated in an easterly direction. The surface manifestations of these packets attain a maximal intensity directly over the ridge peaks in the course of their formation. The collected data are good evidence of the possibilities of acoustic methods for investigating dynamic processes in the ocean in regions with complex topography; in combination with traditional contact measurements they can play a considerable role in studying these phenomena in all stages of their development. Figures 4; references 12: 8 Russian, 4 Western.

UDC 551.465

**Accuracy in Determining Scattering Index of Oceanic Waters by Integral Method**

18650137d Moscow OKEANOLOGIYA in Russian  
Vol 28 No 6, Nov-Dec 88 (manuscript received 23 Apr 86) p 1035

[Article by A. A. Kumeysa, Physics Institute, Belorussian Academy of Sciences, Minsk]

[Abstract] The integral method is one of the methods for determining the scattering index  $\sigma$ . However, with increasing depth in the ocean there is a substantial

transformation of the scattering indicatrix, reflecting changes in the fractional composition of suspended matter. Accordingly, in deep waters (more than 100 m), where the indicatrices are more diffuse, the fraction of the light flux scattered "forward" in a cone with a fixed aperture and accordingly, with a correlation coefficient  $q$ , can be considerably less than in shallower waters. Failure to take this phenomenon into account can result in considerably greater errors in determining  $\sigma$  by the integral method than indicated earlier in the literature based only on an analysis of the variability of indicatrices in near-surface waters. In this article expressions are derived for computing  $q$  and subsequent analysis of its variability with depth on the basis of materials in the literature, separately for the scattering indicatrices in shallow and deep waters. An appropriate optical system is described resembling that used in many photometer designs. The divergent light beam formed by the system is directed through a window into the scattering medium and after reflection from a remote spherical mirror is returned through the window. The light scattered in the beam zone is collected by a conical light conductor and is registered by a photodetector. References: 3 Russian.

UDC 551.465.71(261.24)

**Baltic Sea Water Balance**

18650143e Moscow METEOROLOGIYA I  
GIDROLOGIYA No 3, Mar 89 (manuscript received 5 Mar 88) pp 68-73

[Article by M. V. Ivanov and V. P. Korovin, candidate of technical sciences, Leningrad Hydrometeorological Institute]

[Abstract] The water balance is a decisive factor in formation of the Baltic Sea as a unified geographical feature. The mean monthly values of the water balance components of this sea were determined during the "Experimental Tests Year" (July 1975-December 1976). These data were used in calculating the water balance nonclosure, whose magnitude was comparable to its individual components, indicating the presence of errors not otherwise taken into account. This research was for ascertaining these sources of error. A method is proposed for computing the random and systematic errors. The total error in determining water exchange averages 35% and the error in determining the volume increment is 47%. This indicates that level variations in the Central Baltic must differ from the water exchange variations in the Danish Straits and that the two do not correlate with one another. It is therefore incorrect to compute the water exchange from the level differentials between the Baltic Sea and the Danish Straits. Computation of water exchange from the water balance equation is also fraught with considerable errors. All these factors (and others) must be taken into account in formulating various measures for preserving the Baltic Sea as a unified ecological body. References: 5 Russian.

UDC 551.461.25:551.515.2

### Change in Ocean Surface Level Beneath Tropical Cyclone

18650143f Moscow *METEOROLOGIYA I GIDROLOGIYA* No 3, Mar 89 (manuscript received 3 Aug 87) pp 74-79

[Article by N. S. Yevsa, Moscow State University]

[Abstract] Although recent geophysical literature has devoted much attention to the effect of tropical cyclones on the ocean, most studies apply to processes whose time scales are greater than the inertial period; much less attention has been given to ocean surface processes with lesser time scales. This article clarifies the dynamic effects exerted by a tropical cyclone on the ocean surface at time scales less than the inertial period and the degree to which the formation of long waves under a tropical cyclone is dependent on its parameters. The "shallow water" theory is used in this research. The dependence of ocean surface level excess on the parameters of a tropical cyclone and the depth of the quasihomogeneous layer of the ocean was determined. A series of four numerical experiments was carried out. In the first the depth of the quasihomogeneous layer was varied; in the second the radius of the maximal winds and the extent of the tropical cyclone were varied; in the third friction at the ocean surface was varied; in the fourth the angle of inflow of the wind on the periphery of the tropical cyclone was varied. The research results indicate that the nature of formation and the amplitude of long waves to a high degree are dependent on the individual characteristics of a tropical cyclone. Figures 2; references: 6 Russian.

UDC 551.465.48

### Structure of Synoptic Eddies in Ocean

18650143i Moscow *METEOROLOGIYA I GIDROLOGIYA* No 3, Mar 89 (manuscript received 26 Jan 87) pp 109-113

[Article by Yu. V. Kazantsev, candidate of technical sciences, and V. V. Pokudov, candidate of geographical sciences, Far Eastern Regional Scientific Research Hydrometeorological Institute]

[Abstract] Using a generalized theorem on the conservation of absolute vorticity it is shown that an oceanic eddy consists of an elongated eddy ring whose angular velocities of rotation at the upper and lower levels ensure the known vertical movements of waters. Four possible types of vertical structure of eddies are analyzed: 1) in the upper part of the eddy the motion of the water is anticyclonic and in the lower part cyclonic; 2) in the upper part motion is anticyclonic and in the lower part is anticyclonic; 3) in the upper part motion is cyclonic and in the lower part is anticyclonic; 4) with cyclonic motion at all levels. In this article it is shown that variant 4) is theoretically impossible because in such a case no closed vertical circulation is

formed. A figure illustrates the three possible variants (which are discussed in detail). Interpretation of cases 1) and 3) is easier than case 2). Particular attention is given to the possibility of explaining generation of variant 2) when water viscosity is taken into account. The presence of an oscillatory system in the ocean giving rise to alternate cyclonic and anticyclonic meanders plays a significant role in the formation of these eddies. Figures 3; references 4: 3 Russian, 1 Western.

### Gas Craters in Baltic Sea Studied From Research Ship "Kurchatov"

18650150a Vilnius *SOVETSKAYA LITVA* in Russian 1 Apr 89 p 4

[Article by O. Pustelnikov, Candidate of Geological and Mineralogical Sciences]

[Abstract] The article reports on results of the first stage of an expedition which is studying the origin of gas craters and related problems of marine ecology in the Baltic Sea. Members of this expedition recently completed a 40-day cruise on board the scientific research vessel "Akademik Kurchatov." The vessel's passengers included scientists with different specialties from the USSR, Poland, Hungary, Bulgaria and the German Democratic Republic.

The present facilities of the "Akademik Kurchatov" include 26 laboratories, two computers, and gas-chromatography and atomic-absorption equipment, the author relates. Eighty scientists and the same number of crew members worked on board the vessel at the same time. Contours of seabed crater fields were traced in detail with the aid of an ultrasonic depth finder whose vibrators emit more than 50,000 pulses a second. Signals reflected from the seabed were recorded by a special detector. Samples of water and bottom sediments were taken from craters by means of a piston tube with a vibrator. Using proximate methods, personnel of ship laboratories then analyzed the composition of gases in these samples, as well as phases of hydrocarbons which are direct indicators of petroleum products.

The author mentions that he and two other associates of the Lithuanian Academy of Sciences' geography department—S. Gulvinskis and S. Zaretskas—are studying the physical properties and composition of seabed hydrocarbons with the participation of Professor A. Gaygalas of Vilnius University, who is an eminent geologist. Sediment samples taken during the Baltic cruise are to undergo further study on shore in order to determine whether the hydrocarbons in them are biogenic or anthropogenic.

FTD/SNAP

**Commission To Monitor Ecologic Conditions  
Near Nuclear Testing Grounds**

18650120 Moscow KOMSOMOLSKAYA PRAVDA in  
Russian 23 Mar 89 p 1

[Text] A commission for monitoring observance of the state of ecological conditions in the vicinity of the testing grounds in Semipalatinsk Oblast has been established. This commission is headed by Ye. M. Asanbayev, deputy chairman of the Kazakh SSR Council of Ministers.

After reading this report from the KazTAG wire service, we telephoned G. D. Zurov, a member of the monitoring commission, in order to clarify a number of details.

"The commission was formed on 1 March 1989 [he said]. Its members include officials of the republic Council of Ministers, State Planning Committee and Ministry of Health, nuclear physicists, seismologists, builders, and representatives of the Semipalatinsk Oblast Soviet Executive Committee. An unhealthy ecological situation has developed in the vicinity of the testing grounds. Members of the commission are now there who will study background radiation and its effects on the health of people and animals."

FTD/SNAP

**Effects of "Energiya" and Space Shuttle on Ozone  
Layer Compared**

18650141c Moscow KRASNAYA ZVEZDA in Russian  
24 Mar 89 p 4

[Article by V. Filin, deputy chief designer of the launch-rocket "Energiya" and V. Burdakov, Doctor of Technical Sciences, Professor]

[Excerpt] Reader Ye. Ryabin writes: "Much is being said and written about the 'ozone disaster'. Various reasons for the formation of 'ozone holes' have been mentioned. How do space launches affect the formation of such holes?"

The latest launch of the U.S.' 'space shuttle' took place on 14 March of this year. During this launch alone, about 200 tons of chlorine and chlorine compounds were discharged into the atmosphere at altitudes of zero to 50 kilometers (the upper limit of the ozone layer). According to data of American and British scientists, each chlorine molecule is capable of destroying up to 100,000 (!) molecules of ozone in the stratosphere.

The Soviet launch-rocket "Energiya" has a substantial ecological advantage—there are no chlorides in the composition of its exhaust gases.

FTD/SNAP

UDC 551.510.522

**Three-Layer Structure of Unstably Stratified  
Surface Layer of Atmosphere**

18650109a Moscow IZVESTIYA AKADEMII NAUK  
SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 24 No 12, Dec 88 (manuscript received 13 Oct 87;  
after revision 25 Feb 88) pp 1235-1250

[Article by B. A. Kader, Institute of Atmospheric Physics, USSR Academy of Sciences]

[Abstract] Theoretical and experimental data are presented on the pulsation structure of the steady, horizontally homogeneous surface layer of the atmosphere. Experimental results were obtained in 1981-1987 at Tsimlyansk. The experimental results allow estimation of most of the universal constants used to describe this layer of the atmosphere over a homogeneous and level underlying surface. The results confirm the existence of a layer of free convection, located above a logarithmic sublayer in which turbulence is generated primarily by dynamic forces of friction of the air flow with the underlying surface. The three-layer model of the surface layer suggested agrees well with available experimental data, explaining a number of the contradictions which arise in the two-layer model. Figures 8; references 31: 15 Russian 16 Western.

UDC 551.596.1

**Calculating Parameters of Plane Wave of Finite  
Amplitude in Standard Atmosphere**

18650109b Moscow ISVESTIYA AKADEMII NAUK  
SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 24 No 12 Dec 88 (manuscript received 8 Jul 87;  
after revision 15 Feb 88) pp 1262-1265

[Article by Yu. V. Novikov, V. Ye. Fridman, Gorkiy Scientific Research Radio Physics Institute]

[Abstract] The level of nonlinear distortions of a plane wave propagating along a heterogeneity gradient in a standard atmosphere is calculated, ignoring the influence of wind. Numerical computations are performed in a discontinuous approximation, in which dissipation is considered only in the narrow area around the leading edge of the acoustical field. Equations are presented for the amplitude and duration of shock waves and a method is presented for computing the nonlinear distortion at arbitrary altitude in the atmosphere. Figures 2; References 10: 9 Russian, 1 Western.



UDC 551.510.534:551.501.795

**Restoration of Altitude Distribution of Ozone from Surface Measurements of Integral Absorption in Millimeter Wave Band**

18650109c Moscow *ISVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA* in Russian Vol 24 No 12, Dec 88 (manuscript received 13 Jul 87; after revision 25 Jan 88) pp 1282-1292

[Article by Yu. Yu. Kulikov, N. N. Markina, A. P. Naumov, V. G. Ryskin, M. I. Sumin, Gorkiy Scientific Research Radio Physics Institute; Institute of Applied Physics, USSR Academy of Sciences]

[Abstract] The problem of restoration of the altitude distribution of ozone from surface measurements of absorption in the  $O_3$  line  $10_{0,10}-10_{1,9}$  at resonant frequency  $\nu_0=142175.1$  MHz. The peculiarities of formation of radio radiation in the  $O_3$  line studied are determined by the characteristics of statement of the inverse problem, the method of radiometric measurements is briefly described and the results of restoration of the  $O_3$  profiles from model and field experiments are discussed. Figures 9; References 26: 14 Russian, 12 Western.

UDC 551.510.42:551.510.532:551.521.327

**Influence of Stratospheric Aerosol on Zenith Sky Brightness with Low Sun**

18650109d Moscow *ISVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA* in Russian Vol 24 No 12, Dec 88 (manuscript received 17 Aug 87) pp 1293-1297

[Article by M. A. Nazaraliyev, B. T. Tashenov, K. K. Tolkonchinov, S. A. Ukhinov, Computer Center, Siberian Division, USSR Academy of Sciences]

[Abstract] Observations and model calculations of relative brightness were conducted in the absorption bands of water vapor and oxygen. Analysis of the observation data showed inversion of the variation of relative sky brightness as a function of zenith distance of the sun, not only for small positive sun heights, but also for negative sun heights. An unambiguous relationship was found between the altitude and thickness of the aerosol layer and the curve of this inversion, indicating the influence of aerosol scattering on zenith brightness. Figures 4; References 17: 15 Russian, 2 Western.

UDC 551.510.42

**Problem of Interaction of Clouds with Surrounding Aerosol**

18650109e Moscow *IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA* in Russian Vol 24 No 12, Dec 88 (manuscript received 20 Jul 87) pp 1298-1306

[Article by S. D. Traytak, USSR Academy of Sciences, Department of Theoretical Problems]

[Abstract] A previous article noted that an increase in the mean aerosol particle size and a decrease in particle

concentration near cloud may result from intensive interaction of cloud droplets and the aerosol thermal-diffusion capture of particles by droplets with subsequent evaporation and formation of large condensation nuclei. This article presents a detailed study of the effectiveness of this mechanism, demonstrating that it cannot be the basic cause of the significant decrease in particle concentration and the appearance of gigantic aerosol particles near clouds. It is noted that the effectiveness of phoretic coagulation may be an order of magnitude greater than the effectiveness of brownian coagulation under these circumstances. Figures 2; References 12: 10 Russian, 2 Western.

UDC 551.510.42:551.510.532:551.521.327

**Influence of Stratospheric Aerosol on Zenith Sky Brightness with Low Sun**

18650109d Moscow *ISVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA* in Russian Vol 24 No 12, Dec 88 (manuscript received 17 Aug 87), pp 1293-1297

[Article by M. A. Nazaraliyev, B. T. Tashenov, K. K. Tolkonchinov, S. A. Ukhinov, Computer Center, Siberian Division, USSR Academy of Sciences]

[Abstract] Observations and model calculations of relative brightness were conducted in the absorption bands of water vapor and oxygen. Analysis of the observation data showed inversion of the variation of relative sky brightness as a function of zenith distance of the sun, not only for small positive sun heights, but also for negative sun heights. An unambiguous relationship was found between the altitude and thickness of the aerosol layer and the curve of this inversion, indicating the influence of aerosol scattering on zenith brightness. Figures 4; References 17: 15 Russian, 2 Western.

UDC 551.506:551.558(729.1)

**Data Ensemble for Testing Numerical Models of Convective Clouds**

18650143h Moscow *METEOROLOGIYA I GIDROLOGIYA* No 3, Mar 89 (manuscript received 18 May 88) pp 104-105

[Article by A. N. Taranenko, Central Aerological Observatory]

[Abstract] The increase in the number of models, schools and approaches to description of various processes in convective clouds makes it necessary to select models most correctly reflecting this natural phenomenon. Data banks are needed for the testing of models. They must include descriptions of the development of convection for different geographical regions, synoptic situations, orographic conditions and seasons of the year. However, such data banks do not presently exist in the USSR. This article discusses steps taken to organize such a data bank for modeling convection processes on the basis of real



data collected in the Camaguey test range in Cuba during 1986- 1987, which it is proposed be incorporated into such a bank. The data were collected on 25 August 1986 (observations of the dynamic characteristics of clouds) and 9 September 1987 (dynamic and microphysical characteristics). These data were for a situation with air mass development of convection and small wind shears, typical for this season of the year over Cuba. The various files of collected data of the type to be included in a special data bank as a special case are listed. Specialists in the Cloud Physics and Atmospheric Dynamics Section, Central Aerological Observatory, are now carrying out numerical experiments with a three-dimensional model of convective clouds on the basis of the collected data.

UDC 551.508.5.001.1

### Theory of Mechanical Wind Meters

18650143j Moscow *METEOROLOGIYA I  
GIDROLOGIYA* No 3, Mar 89 (manuscript received  
3 Aug 88) pp 116-118

[Article by N. A. Bagrov, professor, USSR Hydrometeorological Scientific Research Center]

[Abstract] A simple nonlinear theory of wind measuring instruments is proposed. It is assumed that the air flow acts on the blades of a vane or cups of an instrument with a force dependent on the difference  $v(t)-u(t)$  between the instrument readings and wind speed  $u(t)$ . Ideally the instrument readings  $v(t)$  and the true wind speed  $u(t)$  should coincide. But these mechanical instruments always have some inertia: their readings always lag and are smoothed. The article gives the derivation and solves a nonlinear (quadratic) ordinary equation which correctly describes the operation of mechanical wind-measuring instruments. Application of this equation is illustrated in an example. It is shown that then there is no systematic error in estimating mean wind speed for relatively short time intervals. Figures 2; references: 5 Russian.

### Arctic Ozone Layer Studied With Airborne Lidar and Spectrometer

18650149b Moscow *VOZDUSHNYY TRANSPORT* in  
Russian 17 Mar 89 p 4

[Article by V. Torishniy, correspondent]

[Abstract] The article reports on recent studies of the structure and dynamics of the ozonosphere over the Arctic.\* An IL-18D "Tsiklon" laboratory airplane has been used in this research program, which includes studies of features of ozone distribution and atmospheric pollution and stratospheric aerosols which affect ozone. That certain atmospheric formations in the Arctic diffuse light abnormally was confirmed last year with the aid of airborne lidar, it is recalled.

Doctor of Physical-Mathematical Sciences I. Karol and V. Dosov, head of the department of laser research methods of the USSR State Committee on Hydrometeorology's Central Aerological Observatory and scientific director of the Arctic expedition, are quoted in regard to atmospheric phenomena which enable ozone-destroying substances to accumulate in polar regions. Dosov explained that spring is the season in which rays of the sun appear in the Arctic at altitudes of 20-30 kilometers, causing small ice crystals to evaporate. Chemical compounds in these crystals which affect ozone are released. Freons which persist in the atmosphere for years and even decades break down from the effect of ultraviolet radiation and liberate pure atomic chlorine which is particularly destructive to ozone.

An account is given of a research flight over the Arctic Ocean. Airborne equipment used during this flight included lidar, an ozonometer and a spectrometer, as well as a system for taking air samples and sealing them in special capsules for subsequent gas-chromatographic analysis. The lidar was used to determine the altitude, geography and composition of atmospheric phenomena. Ozonometric and spectrometric studies of moonlight were made for the purpose of determining the concentration of ozone and the content of ozone-destroying substances in the atmosphere, respectively.

\* See also the Daily SNAP, 21 February 1989, p 1 col 1

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